U.S. Environmental Protection Agency
Toxic Substances Control Act (TSCA)

SECTION 403 RULEMAKING

"...identify lead-based paint hazards, lead-contaminated dust, and lead-contaminated soil."

SECTION 403 DIALOGUE PROCESS

BACKGROUND INFORMATION AND DISCUSSION GUIDE

DUST DISCUSSION ISSUES

Battelle
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SUPPORT MATERIALS FOR THE SECTION 403 DIALOGUE PROCESS

Enclosed in this second package of support materials for the Section 403 Dialogue process are:

- "Residential Dust Containing Lead: Discussion Issues"

- "A Summary of the Relationship Between Blood Lead and Lead-Contaminated Soil and Lead-Contaminated Dust, as Reported in the Scientific Literature." This paper summarizes results in the scientific literature characterizing the relationship between blood-lead levels in children and lead-contaminated soil and lead-contaminated dust.

RESIDENTIAL DUST CONTAINING LEAD

DISCUSSION ISSUES

The Environmental Protection Agency (EPA) is seeking comment and insight into a range of relevant issues related to elevated lead levels in household dust. What follows are a series of discussion issues with associated questions. Where appropriate, supporting text is provided to guide the discussion.

ISSUE 1. ***What are the most important factors (e.g., protectiveness, cost, achievability, etc.) to consider and what weight should be given to each factor in setting a standard for dust?***

Illustrated below are a series of estimates of the relationship between the probability that a child will have an elevated blood-lead level and the average floor dust-lead level in the child's residence, based on different populations. These different estimates of the relationship are presented for the purpose of aiding the dialogue process discussion and <u>DO</u> <u>NOT</u> represent any final estimated relationship the EPA will use in its risk assessment. They are presented as hypothetical draft illustrations for discussion purposes only. The relationship was estimated and presented for both dust-lead concentration and dust-lead loading. Figures 1, 2, and 3 below illustrate the relationship based on dust-lead concentration and three different data sources: 1) HUD National Survey homes with use of the IEUBK model to predict the probability that a child's blood-lead level would exceed 10 µg/dL, 15 µg/dL, or 20 µg/dL; 2) Rochester Lead-In-Dust Study [3] observed dust-lead concentrations and blood-lead levels; and 3) Baltimore Repair and Maintenance Study [4] observed dust-lead concentrations and blood-lead levels. Figures 4, 5, and 6 present the same information based on dust-lead loadings, without the IEUBK predictions.

When establishing a standard for dust, EPA's task can be seen as choosing points along the estimated relation between level of protectiveness (reduction in future blood-lead levels) and cost (prevalence of dust-lead loading or concentration). EPA is seeking the input of dialogue participants on what are the most important factors (e.g., protectiveness, cost, achievability) to consider when choosing those points.

Technical aspects of the graphs are not the subject for discussion during the dialogue process. The graphs do not indicate the uncertainty (which is substantial) in the relationship or what is the estimated effect of an abatement (i.e., how the curve will shift with intervention occurring for homes above a certain dust level) .

Recognizing these limitations, what are the most important factors you would consider in choosing a regulatory standard for dust?

Subissue Numerous studies have indicated that the incidence of elevated blood-lead levels is not uniform across the nation. For example, the third National Health and Nutrition Examination Survey showed that elevated blood-lead levels are found in "pockets" related to urban status and various sociodemographic factors. Levels were higher in central city areas, for younger ages, males, non-Hispanic black race/ethnicity, and low income levels. Moreover, other studies have indicated that the effect of these factors is still significant even after adjusting for measured environmental levels.

Given this information, it may be that the use of national distributions of environmental lead levels may not effectively target the areas where the greatest potential lead problems exist. Is there some other approach (i.e., other than nationally-applied hazard standards) that results in workable standards that better target these problem areas?

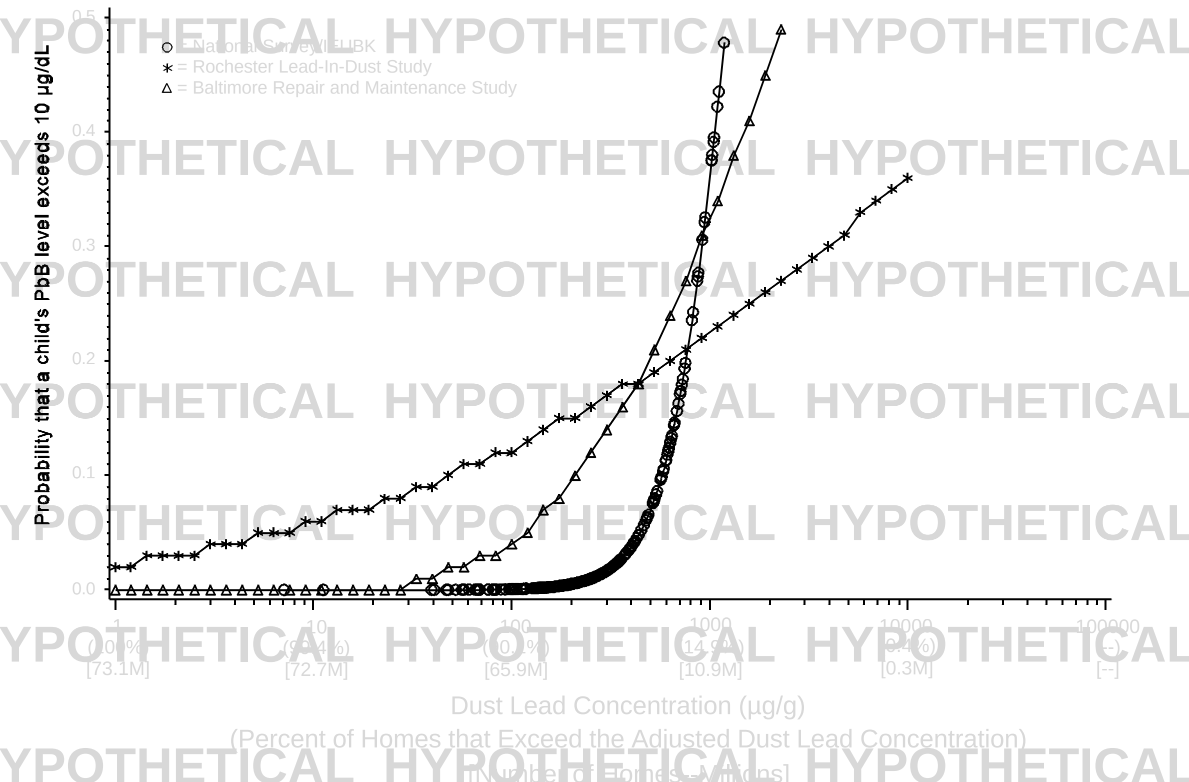

Figure 1. **Hypothetical Illustration of Estimated Relationships[1] Between the Probability of Blood Lead Levels Greater than 10 µg/dL and Dust Lead Concentration**

[1]This figure is a hypothetical illustration and is for purposes of discussion only. The analysis has not been subject to technical review by Agency personnel. The curve representing the HUD National Survey data was calculated in the following manner. For each house in the HUD National Survey the arithmetic average of three soil samples (exterior entranceway, dripline, and remote site) and the arithmetic average of three floor-dust samples (dry room, entranceway, and wet room; collected by the "blue nozzle" method) were used as inputs to the IEUBK model along with default parameters as defined in preliminary Section 403 economic modeling. The model's estimate of a geometric mean blood-lead concentration for a three-year-old child, combined with an estimated geometric standard deviation of 1.6 was used to calculate the exceedance probability for each house. A weighted (using the National Survey weights for each house) logistic regression model was fit to these exceedance probabilities and the predicted values from that model were used to plot the curve. The use of the IEUBK model applied to the HUD National Survey data assumes a child has chronic exposure to the observed environmental lead levels.

The curves representing the Baltimore Repair and Maintenance Study and the Rochester Lead-In-Dust Study are based on estimated exceedance probabilities calculated using the results of log-linear regression models (adjusted for measurement error) relating children's blood-lead concentrations to weighted (by sample mass) arithmetic average floor dust-lead concentrations. Floor dust samples were collected as composite samples from homes in Baltimore and as individual samples from homes in Rochester. All floor dust samples used in the analyses were collected from uncarpeted floors using the Baltimore Repair and Maintenance vacuum method. For both studies, the model also accounted for seasonal variations in blood-lead concentrations, and exceedance probabilities were calculated for blood-lead concentrations near the seasonal median. In contrast to the HUD National Survey/IEUBK model approach, the Baltimore and Rochester models may include children who spend significant amounts of time away from the primary residence (e.g., at daycares or babysitters).

It should be noted that there are many differences between the studies (populations, dust collection methods, etc.) and approaches (IEUBK model predictions, empirical models fit to observed blood-lead levels) used to generate the different curves that cannot receive full discussion here.

The percent of homes exceeding each dust lead concentration was estimated from the HUD National Survey data using assigned weights for each sampled house. The estimated percent and number of homes were based only on pre-1980 housing stock at the time of the most recent HUD National Survey analysis.

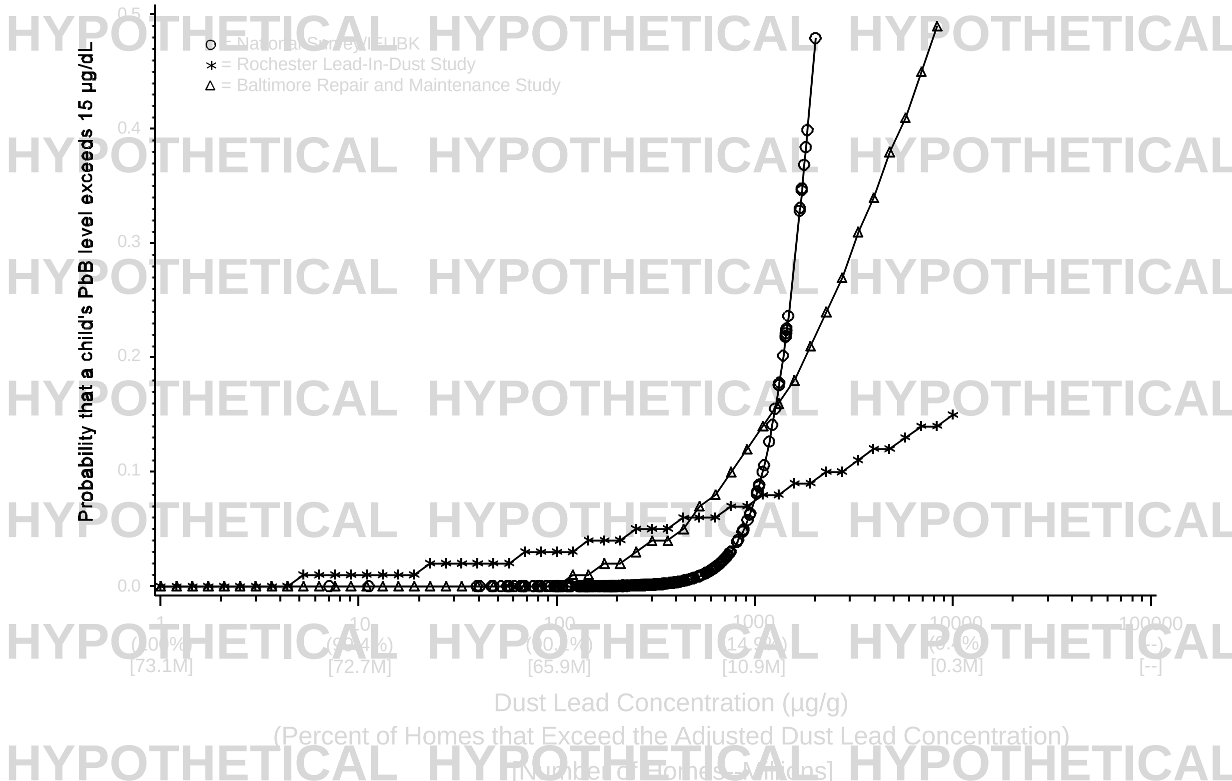

Figure 2. **Hypothetical Illustration of Estimated Relationships[2] Between the Probability of Blood Lead Levels Greater than 15 µg/dL and Dust Lead Concentration**

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[2]This figure is a hypothetical illustration and is for purposes of discussion only. The analysis has not been subject to technical review by Agency personnel. The curve representing the HUD National Survey data was calculated in the following manner. For each house in the HUD National Survey the arithmetic average of three soil samples (exterior entranceway, dripline, and remote site) and the arithmetic average of three floor-dust samples (dry room, entranceway, and wet room; collected by the "blue nozzle" method) were used as inputs to the IEUBK model along with default parameters as defined in preliminary Section 403 economic modeling. The model's estimate of a geometric mean blood-lead concentration for a three-year-old child, combined with an estimated geometric standard deviation of 1.6 was used to calculate the exceedance probability for each house. A weighted (using the National Survey weights for each house) logistic regression model was fit to these exceedance probabilities and the predicted values from that model were used to plot the curve. The use of the IEUBK model applied to the HUD National Survey data assumes a child has chronic exposure to the observed environmental lead levels.

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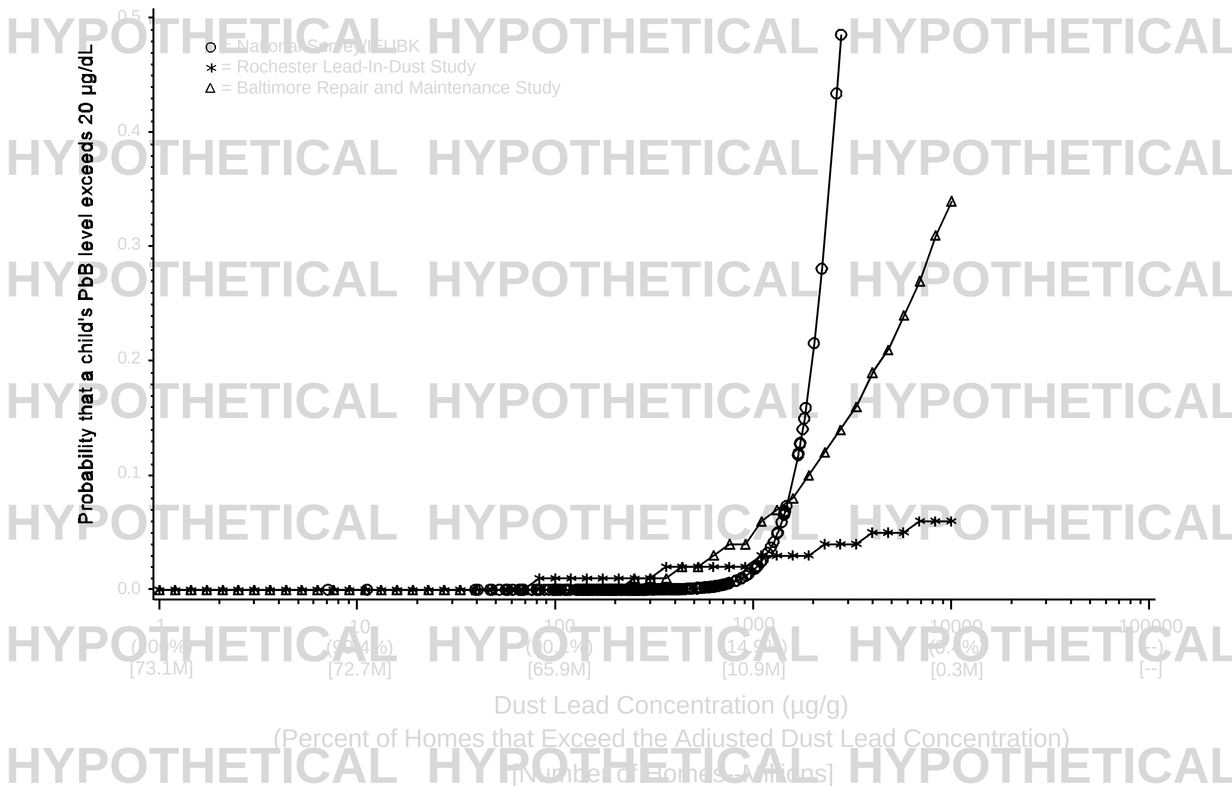

Figure 3. Hypothetical Illustration of Estimated Relationships[3] Between the Probability of Blood Lead Levels Greater than 20 µg/dL and Dust Lead Concentration

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[3]This figure is a hypothetical illustration and is for purposes of discussion only. The analysis has not been subject to technical review by Agency personnel. The curve representing the HUD National Survey data was calculated in the following manner. For each house in the HUD National Survey the arithmetic average of three soil samples (exterior entranceway, dripline, and remote site) and the arithmetic average of three floor-dust samples (dry room, entranceway, and wet room; collected by the "blue nozzle" method) were used as inputs to the IEUBK model along with default parameters as defined in preliminary Section 403 economic modeling. The model's estimate of a geometric mean blood-lead concentration for a three-year-old child, combined with an estimated geometric standard deviation of 1.6 was used to calculate the exceedance probability for each house. A weighted (using the National Survey weights for each house) logistic regression model was fit to these exceedance probabilities and the predicted values from that model were used to plot the curve. The use of the IEUBK model applied to the HUD National Survey data assumes a child has chronic exposure to the observed environmental lead levels.

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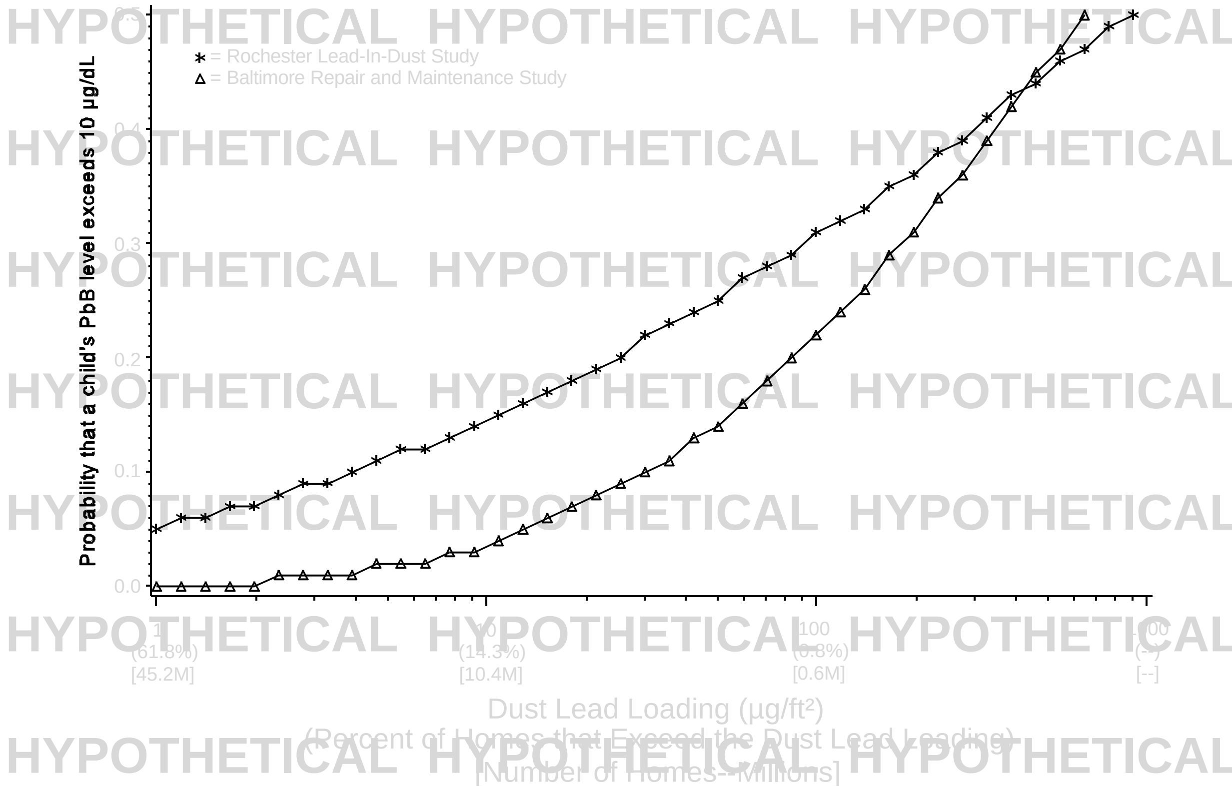

Figure 4. Hypothetical Illustration of Estimated Relationships[4] Between the Probability of Blood Lead Levels Greater than 10 µg/dL and Dust Lead Loading

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[4]This figure is a hypothetical illustration and is for purposes of discussion only. The analysis has not been subject to technical review by Agency personnel. The curves representing the Baltimore Repair and Maintenance Study and the Rochester Lead-In-Dust Study are based on estimated exceedance probabilities calculated using the results of log-linear regression models (adjusted for measurement error) relating children's blood-lead concentrations to weighted (by area) arithmetic average floor dust-lead loadings. Floor dust samples were collected as composite samples from homes in Baltimore and as individual samples from homes in Rochester. All floor dust samples used in the analyses were collected on uncarpeted floors using the Baltimore Repair and Maintenance vacuum method. The model also accounted for seasonal variations in blood-lead concentrations, and exceedance probabilities were calculated for blood-lead concentrations near the seasonal median.

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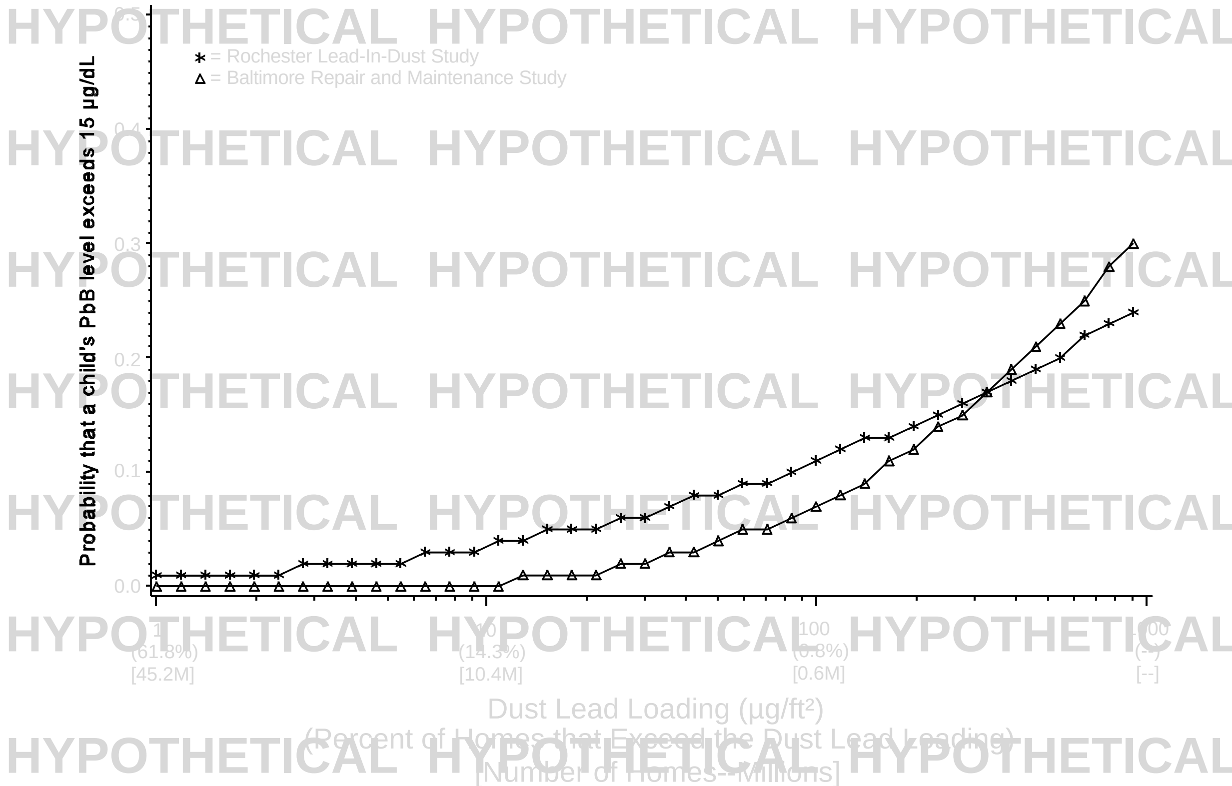

Figure 5. **Hypothetical Illustration of Estimated Relationships[5] Between the Probability of Blood Lead Levels Greater than 15 µg/dL and Dust Lead Loading**

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[5]This figure is a hypothetical illustration and is for purposes of discussion only. The analysis has not been subject to technical review by Agency personnel. The curves representing the Baltimore Repair and Maintenance Study and the Rochester Lead-In-Dust Study are based on estimated exceedance probabilities calculated using the results of log-linear regression models (adjusted for measurement error) relating children's blood-lead concentrations to weighted (by area) arithmetic average floor dust-lead loadings. Floor dust samples were collected as composite samples from homes in Baltimore and as individual samples from homes in Rochester. All floor dust samples used in the analyses were collected on uncarpeted floors using the Baltimore Repair and Maintenance vacuum method. The model also accounted for seasonal variations in blood-lead concentrations, and exceedance probabilities were calculated for blood-lead concentrations near the seasonal median.

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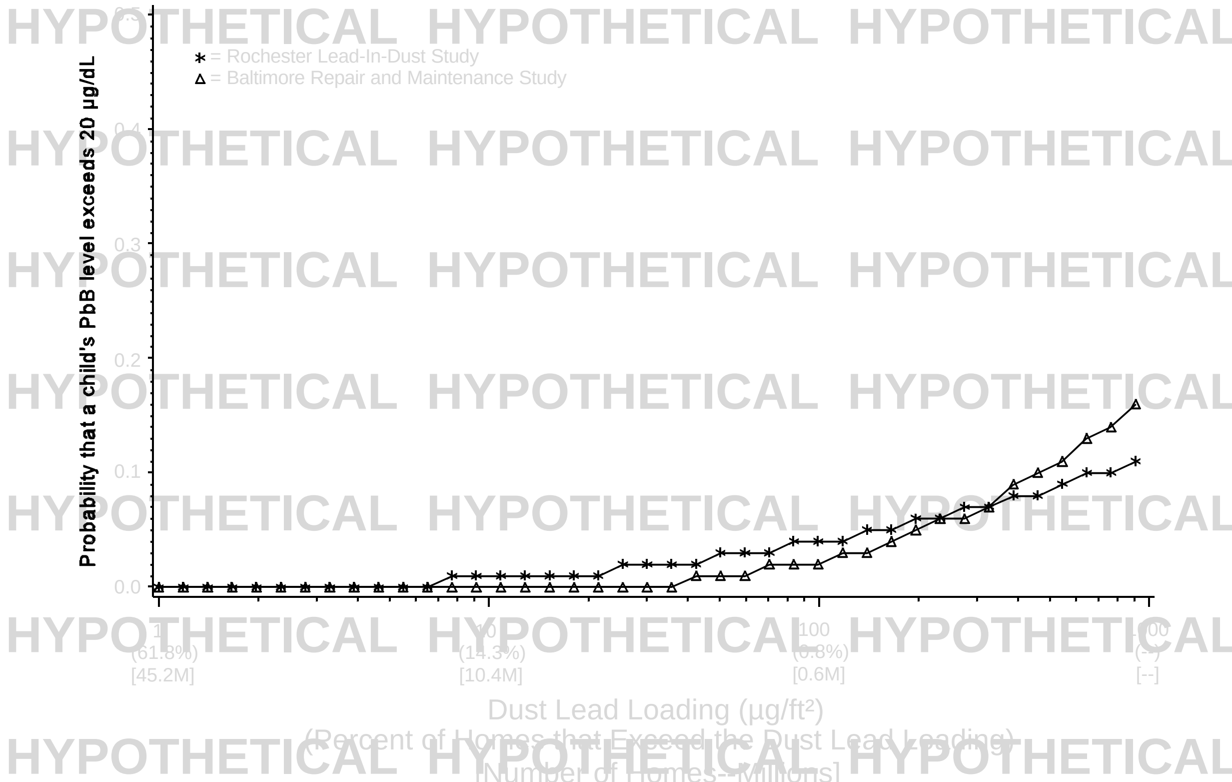

Figure 6. Hypothetical Illustration of Estimated Relationships[6] Between the Probability of Blood Lead Levels Greater than 20 μg/dL and Dust Lead Loading

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[6]This figure is a hypothetical illustration and is for purposes of discussion only. The analysis has not been subject to technical review by Agency personnel. The curves representing the Baltimore Repair and Maintenance Study and the Rochester Lead-In-Dust Study are based on estimated exceedance probabilities calculated using the results of log-linear regression models (adjusted for measurement error) relating children's blood-lead concentrations to weighted (by area) arithmetic average floor dust-lead loadings. Floor dust samples were collected as composite samples from homes in Baltimore and as individual samples from homes in Rochester. All floor dust samples used in the analyses were collected on uncarpeted floors using the Baltimore Repair and Maintenance vacuum method. The model also accounted for seasonal variations in blood-lead concentrations, and exceedance probabilities were calculated for blood-lead concentrations near the seasonal median.

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The percent of homes exceeding each dust lead concentration was estimated from the HUD National Survey data using assigned weights for each sampled house. The estimated percent and number of homes were based only on pre-1980 housing stock at the time of the most recent HUD National Survey analysis.

ISSUE 2. ***Should vacuum sampling be included in the dust standard?***

By utilizing vacuum sampling, dust-lead concentration, dust-lead loading, and dust loading can be measured. Wipe sampling can only measure dust-lead loading. Lead loading alone does not necessarily provide sufficient information for characterizing the extent of a hazard due to the fact that high lead loadings can result from many different types of samples including a small amount of dust with high lead concentration, or a large amount of dust with relatively low lead concentration. High lead loading results combined with high lead concentration results represent lead hazard from contaminated dust and may also indicate an ongoing source of lead that should be addressed. High lead loading combined with low concentration, on the other hand, may indicate the presence of excessive dust in the area sampled that may be able to be addressed by routine housecleaning. Determining loading requires only wipe sampling, for which accepted collection methods exist and which does not require expensive equipment. The American Society for Testing and Materials (ASTM) is attempting to develop a consensus method for vacuum sample collection.

If a standard is established based on dust-lead concentration or on both concentration and loading, then vacuum sampling for dust would be necessary. Another possibility is that a standard could be established that only requires dust-lead concentration information (and therefore vacuum sampling) in certain situations (e.g., when the floors in a home are all carpeted).

Table 22 in Section 6 of "Lead in Residential Paint, Dust, and Soil: Background Information" presents a comparison of sampling and analysis costs for collection of ten individual dust samples by wipe sampling versus vacuum sampling.

Should vacuum sampling be included in the dust standard, considering the tradeoff between the increase in information and issues of affordability, availability, and feasibility of vacuum sampling?

ISSUE 3. ***Should the regulation establish standards for window sills and troughs?***

EPA's Section 403 Interim Guidance includes advisory dust-lead loadings for floors, window sills, and window troughs, using the clearance levels in the HUD Guidelines. However, clearance standards for troughs and sills may be handled separately in this rulemaking from that of hazard standards for sills and troughs. There is mixed evidence whether window sills and troughs provide additional information about blood-lead concentrations after accounting for the contribution of uncarpeted floors. In the Baltimore Repair and Maintenance Study, dust-lead loadings from sills and troughs explain virtually no additional variability in blood-lead levels over a model based on floor dust-lead loadings. The data from the Rochester Lead-In-Dust Study, on the other hand, suggest that additional variability in blood-lead levels can be explained by the addition of sills or troughs to a model based on floor dust-lead loadings. The most likely pathway for lead in dust is inadvertent ingestion of dust on floors and possibly sills. Lead-dust levels on all three surfaces, however, can provide risk assessors information in determining the source of the lead in the dust. In addition, troughs are more difficult to clean than floors and may provide a more accurate indicator of hazard over time. In light of these considerations, on what surfaces should EPA set Section 403 hazard assessment standards for dust?

Window sills and especially troughs are more difficult to clean due to repeated opening/closing of the window. Post-abatement cleanup of all surfaces is important to prevent recontamination, suggesting that clearance levels for all three surfaces are appropriate. If no hazard levels are established for sills or troughs, should there nevertheless be clearance standards for these surfaces?

ISSUE 4. ***Should the dust standard apply to porches, stoops, decks, etc.?***

ISSUE 5. ***How should homes with carpeted floors in all primary living areas be handled?***

Most research and development of sampling protocols and clean-up methods has been guided by needs identified during abatements. Carpeted surfaces are usually not present after an abatement. Therefore, protocols for wipe sampling have been developed and evaluated mostly for uncarpeted surfaces. Likewise clean-up methods have also been designed and evaluated for uncarpeted surfaces. However, in a risk assessment or hazard evaluation, many homes will have predominantly carpeted floor surfaces.

How should homes with predominantly carpeted floors be sampled?

What recommended response actions should be associated with homes that fail a dust standard and have predominantly carpeted floors? Do you know of any data that addresses the efficiency of lead removal for different clean-up methods for carpet?

ISSUE 6. ***Is there any representative data other than the HUD National Survey [3] that can be used to estimate the national prevalence of lead in dust?***

Section 3 of "Lead in Residential Paint, Dust, and Soil: Background Information" presented prevalence data from the HUD National Survey. It should be noted that these numbers are estimates of the prevalence of lead nation-wide (in all privately-owned, occupied residential housing built before 1980). There may well exist categories of locations (e.g., large northeast urban areas) where levels of lead are generally much higher than the national average. EPA intends to use the HUD National Survey data in assessing the effect of the Section 403 standards, but is interested in other representative data if it exists. Are you aware of any such data and could it be provided to EPA?

RESIDENTIAL DUST CONTAINING LEAD

REFERENCES

[1] U.S. Environmental Protection Agency, "Guidance on Identification of Lead-Based Paint Hazards;" Notice. Federal Register, pp 47248-47257, September 11, 1995.

[2] U.S. Environmental Protection Agency, "Report on the National Survey of Lead-Based Paint in Housing—Appendix II: Analysis." Office of Pollution Prevention and Toxics, EPA 747-R95-005, April 1995.

[3] The University of Rochester School of Medicine and The National Center for Lead-Safe Housing, (1995) "The Relation of Lead-Contaminated House Dust and Blood Lead Levels Among Urban Children," Departments of Pediatrics, Biostatistics, and Environmental Medicine, Final Report, Volume 2, June 1995.

[4] Strauss, Warren J. and Steven W. Rust, (1995). "Statistical Evaluation of the Relationship Between Blood-Lead and Dust-Lead Based on Pre-intervention Data from the R&M Study," Battelle deliverable to U.S. Environmental Protection Agency on Task 3-13 Contract 68-D2-0139, September 1995.